

# **International Conference on Biofuels Biofuels as a driving force of Sustainable Development, Sao Paulo, Brazil: Trip Report**



Prepared by Michael Jack

November 2008

## Summary

This report provides a summary of information arising from the international conference on biofuels held in Brazil on the 17-20 November 2008, and considers how it relates to New Zealand's bioenergy interests. Since New Zealand is beginning to trade in biofuels and is likely to develop a domestic biofuels industry, it is necessary to follow the international context closely.

The highlights of the conference were:

1. Coverage of the broad international context surrounding biofuels, including issues such as: potential future contribution to global energy supplies; biofuels as a route to economic development for developing countries; sustainability; certification and trade; and the role of innovation.
2. Information on the development of the biofuels industry in Brazil (and the direction in which it is heading) in particular, coverage of the role of research and innovation in this development.

Brazil's leadership role in biofuels was evident at the conference, not just in the domestic production of biofuels but also in the international arena. Brazil is poised to double domestic ethanol production and is actively pursuing the expansion of sugarcane ethanol production to other countries in Latin America and sub-Saharan Africa. If Brazil is to realise its aim of displacing 10% of the global petrol demand with sugarcane ethanol from increased Brazilian production and expansion to Latin America and sub-Saharan Africa, then this will have a significant impact on New Zealand ethanol imports and domestic production.

Based on the international context, domestic production in New Zealand from a plantation forestry-based biofuels industry (as outlined in the Bioenergy Options for New Zealand reports) has a number of advantages:

- sustainability certification for forests already exists and is well developed;
- indirect impacts of biofuels such as deforestation become a non-issue;
- competition with food is also a non-issue as long as arable land is not utilised;
- plantation forests out-perform agricultural crops from a biodiversity perspective;
- fertiliser and irrigation are reduced compared to agricultural crops; and
- utilising an existing forestry industry (similar to the Brazilian case, which was based on a sugarcane industry).

These aspects will be relevant even if New Zealand is not selling on the international market, as the certification of biofuels is likely to also impact on the footprints of export products and the tourism industry. Ironically, as the international focus is largely on the negative aspects of biofuels from agricultural crops, the benefits of biofuels, based on plantation forestry, does not feature on the agenda of most international discussions.

The conference provided a range of insights into the development of a successful domestic biofuels industry. A clear message from the conference was the need for cross-sectorial cooperation on biofuels in government. The Brazilian government has an inter-ministerial working group on biofuels made up of high-level officials; the US has a cross-sectorial biomass research and development board which coordinates all government-funded research in bioenergy. These may be models the New Zealand Government could adopt.

Based on the information presented at the conference, the development of the biofuels industry is a research and development success story, with impressive gains and innovation throughout the biofuels production chain over the last 25 years. These gains and innovations include:

- doubling sugarcane productivity;
- tripling ethanol yield per hectare;

- reduction in production costs by more than 60%; and
- development of the flexi-fuel vehicle.

Technological innovation seems to be a key aspect to the Brazilian story and this requires not just basic research and development, but pathways for uptake by industry and facilitation by government.

There are three broad avenues where research collaboration with Brazil could be of benefit to New Zealand:

1. lignocellulosic biofuels;
2. sustainable land-based production systems; and
3. strategic development of biofuels in New Zealand.

Although many countries are also pursuing lignocellulosic ethanol and research and development investments may be greater in these countries, Brazil may, in fact, be the first country to implement lignocellulosic biofuel technologies (integrated with their more traditional production systems) on a commercial scale. The reasons for this are:

1. Brazil is the only country with a robust biofuels industry in place.
2. This industry is facing clear drivers to increase energy efficiency and yields (which includes moving to lignocellulosic technologies).
3. There seem to be robust mechanisms in place for developments to be taken up by industry.

The area of sustainable land-based production systems was also identified as an area for collaboration by John Gifford in his report on his trip to Brazil in June 2007 (sponsored by the Ministry of Foreign Affairs and Trade). The sugarcane biofuels industry is facing clear drivers from international trading partners to increase the sustainability of their production systems. This has resulted in increased research into: reduced water use; increased nutrient recycling; and efforts to decrease fossil-fuel based fertilisers. This is an opportunity to leverage New Zealand's expertise in sustainable land-based management and production and also growing expertise in life-cycle management.

New Zealand is likely to attempt to develop a domestic biofuels industry based on forestry. A key similarity with the Brazilian sugarcane bioethanol industry is that they were both based on existing industries. The Brazilian learnings could be a key input into understanding the pathway that New Zealand could pursue in developing this industry, including the role of government, industry and research. This is especially relevant to government representatives involved in developing bioenergy policy in New Zealand. A key aspect of the Brazilian success story is the role of innovation. This innovation has occurred right along the production chain, from sugarcane breeding through to the development of flexi-fuel vehicles. It is important for New Zealand to understand the mechanisms that enabled this to occur and see how it could be adopted here. The Centre for Strategic Studies and Management (CGEE) in Brazil could be a useful partner in this area.

## **Acknowledgements**

The author appreciates the thoughtful assistance of Rebekah Riley and Matthew Paterson in organising accommodation and travel to Sao Paulo.

# Table of Contents

Summary .....	i
Acknowledgements.....	ii
Introduction.....	1
The Conference.....	1
Opening Statements by Brazilian officials .....	1
Plenary session I: Biofuels and Energy Security .....	1
Plenary session II: Biofuels and Climate Change .....	2
Plenary session III: Biofuels and Sustainability .....	3
Special session: The role of Science in Biofuels .....	4
Plenary session IV: Biofuels and Innovation.....	4
Plenary session V: Biofuels and the international market.....	5
Perspectives .....	6
Implications for New Zealand.....	7
International context and implications for a future New Zealand biofuel industry .....	7
New Zealand biofuel research and development.....	8
References .....	9
Appendix: Conference Notes .....	9
Opening Statements by Brazilian Officials.....	9
Plenary session I: Biofuels and Energy Security .....	9
Plenary session II: Biofuels and Climate Change .....	10
Plenary Session IV: Biofuels and innovation .....	12
Plenary session V: Biofuels and the International Market.....	13

## Introduction

Michael Jack was invited by the Ministry of Foreign Affairs and Trade to attend an international conference on biofuels held in Brazil from 17-20 November 2008. Accommodation in Brazil was arranged by The First Secretary of the New Zealand Embassy, Matthew Paterson and travel by Rebekah Riley of the Ministry of Foreign Affairs and Trade.

## The Conference

The “International Conference on Biofuels: Biofuels as a driving force of sustainable development” was held in Sao Paulo, Brazil from the 17-21 November. The author attended the Plenary Sessions, which were scheduled from the 17-19 November. An invitation-only “High-level Intergovernmental Meeting” was held on 20-21 November and was to be informed by the discussions in the plenary sessions. This second part of the conference was attended by Matthew Paterson from the NZ Embassy in Brazil.

The conference was organised by the Brazilian Government’s Inter-ministerial Working Group on Biofuels. This group comprised high-ranking officials from the major ministries, including the Chief of Staff and the Minister of Agriculture. The intention of the organisers was to encourage international debate on the challenges and opportunities associated with biofuels. Brazil plans to double its production of biofuels in order to meet the growing international market. This conference demonstrates that Brazil is taking a leadership role in the international trade and development of biofuels.

The plenary sessions were organised as discussion forums, consisting of a panel of international experts who presented their perspectives on the topic followed by an opening up of the discussion to members of the audience for comment and questions. One member of the expert panel was to report the findings of the discussion to the “High-level Intergovernmental Meeting”.

The conference was attended by 3000 participants including 92 international delegations. The international panel members consisted of a broad range of very high quality international “experts”. The translation, conference material and other conference facilities were excellent.

## Opening Statements by Brazilian officials

Opening statements were given by members of the Inter-Ministry Working Group on Biofuels. This committee was made up of very senior Brazilian Government officials, including the Chief of Staff and the Minister for Agriculture, and demonstrated the emphasis the Brazilian government is placing on biofuels. Detailed notes are given in the Appendix.

## Plenary session I: Biofuels and Energy Security

This session covered the concept of peak oil and the political instabilities of the main oil-producing countries and the impact of these on energy security, especially for transport fuel. Within this context, the session explored the potential of sugarcane-based ethanol to assist in the transition away from oil. The key drivers for this are:

- Sugarcane ethanol has an energy return on energy invested of 8:1.
- Twenty-three million hectares (mainly in Latin America and sub-Saharan Africa) could produce 10% of the global petrol consumption (in comparison, the world has 13 billion ha of arable land, 1.5 billion ha currently used for food production).
- At 10% levels bioethanol can be used in current vehicles and with only limited changes in current infrastructure.

*Background reading for this session can be found at*  
[http://www.biofuels2008.com/en/discursos\\_documentos.php](http://www.biofuels2008.com/en/discursos_documentos.php)

## Panel members

- Márcio Zimmermann (Vice-Minister of Mines and Energy, Brazil)
- Paul Roberts (Author of “The End of Oil” and “The End of Food”, USA)
- Alan Kardec Pinto (CEO of Petrobras Biofuels, Brazil)
- Christoph Berg (Managing Director of F.O. Lect, Germany)
- Ibrahim Assane Mayaki (Former Prime-Minister of Niger, Niger)
- Richard Jones (Deputy Executive Director of International Energy Agency, USA)
- Richard Murphy (Imperial College, UK)

## Key points

- International Energy Agency (IEA) business-as-usual (BAU) scenario: oil, gas and coal usage will rise; greenhouse gases (GHG) will skyrocket; global temperatures will rise 6 degrees (corresponding to disastrous global consequences, IPCC).
- Alternative scenario: lower fuel prices; lower GHG emissions through increasing energy efficiency (50% contribution), increasing renewable energy (25%), carbon capture and storage (15%), and increased nuclear (10%). In this scenario biofuels 1.5% share of energy mix (now); 8% by 2030; 26% by 2050
- In developing countries, many people do not have access to modern energy forms, such as electricity.
- Energy efficiency and demand-side management is as important, if not more so, than renewable supplies.
- Developing regions, such as Africa where 88% of arable land is not utilised, have a huge potential for producing biofuels, but lack infrastructure.
- Price is critical. Coal-to-liquids and tar sands are real alternatives.
- By 2018/2019, first-generation ethanol will not be enough and will require next generation technologies.
- If Brazil only is supplying ethanol this does not help security of supply.

Detailed notes are given in the Appendix.

## Plenary session II: Biofuels and Climate Change

This session explored the areas of climate change, the Kyoto Protocol and Clean Development Mechanism and the role biofuels may have in this area. There was a particular focus on sugarcane ethanol, which has 90% avoided emissions. If a 10% mix of ethanol in petrol was introduced globally this would result in reducing global GHG emissions by 6%.

*Background reading for this session can be found at  
[http://www.biofuels2008.com/en/discursos\\_documentos.php](http://www.biofuels2008.com/en/discursos_documentos.php)*

## Panel

- Luiz Pinguelli Rosa (Executive-Secretary of the Brazilian Forum on Climate Change, Brazil)
- Thomas C. Heller (Professor at Stanford University, USA)
- Christopher Flavin (President of Worldwatch Institute, USA)
- Sir David King (University of Oxford, UK)
- Fabio Feldmann (Executive-Secretary of the Sao Paulo Forum on Global Climate Change and Biodiversity, Brazil)
- Raúl Estrada-Oyuela (Argentina, President of the negotiation process of the Kyoto Protocol, Argentina)
- Thierno Bocar Tall (Director of the African Biofuels and Renewable Energies Fund, Senegal)

## Key points

- The simple, highly general government responses to the Kyoto Protocol, such as cap and trade, are likely to be replaced by a more complex system of specific supporting policies.
- The result of the G8 meeting was an agreement to reduce GHG by 50% by 2050. Currently 36 billion tonnes, under BAU rises to 68 billion tonnes. G8 agreement means we need to reduce to 16 billion tonnes. This is equivalent to reducing GHG emissions to 2 tonnes per person in every country by 2050 (currently, India: 1 tonne/pers, US: 25 tonne/pers). Approach:
  - ▶ energy efficiency and demand side management;
  - ▶ renewable energy;
  - ▶ carbon capture and storage; and
  - ▶ avoid deforestation.
- African nations are responsible for only a small proportion of GHG emissions, but are likely to be significantly affected by climate change.
- It is important to remember that the science of climate change is different from the conventions that we have put in place.
- Fairest approach to climate change is agreements based on emissions per capita.
- Use current credit and ecological crises as an opportunity to reinvent ourselves and consider new paradigms (e.g., integrated production of food and energy).

Detailed notes are given in the Appendix.

## Plenary session III: Biofuels and Sustainability

This session covered a number of aspects of sustainability beyond climate change:

1. Sustainability criteria (including deforestation).
2. Food security.
3. Ecosystem biodiversity, social and economic aspects.

*Background reading for this session can be found at  
[http://www.biofuels2008.com/en/discursos\\_documentos.php](http://www.biofuels2008.com/en/discursos_documentos.php)*

### Panel

- Marina Silva (Senator and former Minister of Environment, Brazil)
- Ignacy Sachs (Professor Emeritus of the Ecole des Hautes en Sciences Sociales, France)
- Alicia Bárcena (Executive-Secretary of the Economic Commission for Latin America and the Caribbean, Mexico)
- Armando Marianete Carviho (Vice-president of the National Bank for Social and Economic Development, Brazil)
- Enrique Iglesias (Secretary-General of Ibero-American Co-operation, Uruguay)
- Maria das Graças Silva Foster (Director of Gas and Energy, Petrobras, Brazil)
- Per Carstedt (CEO of the SEKAB group, Sweden)
- Roberto Smeraldi (Director of the NGO Amigos da Terra/Amazônia Brasileira, Brazil)

## Key points

- Need to develop a certification system for agriculture, as in forestry.
- Need to remove hidden agendas as part of the certification systems.

- Biofuels could help the economic development of Africa by providing access to:
  - ▶ an international market;
  - ▶ modern practice; and
  - ▶ modern technology.
- Opinion from the audience: Sustainability of Brazilian ethanol has proven there is no need for further debate.
- Will America now move away from corn-to-ethanol?
- Opinion from the audience: In Africa, certification is not important as rural development compensates.

## **Special session: The role of Science in Biofuels**

This was a much smaller, less formal session and it covered a lot of the ground that was subsequently covered in Plenary Session IV. The President of Brazilian Academy of Science gave an extremely informative talk on the biofuels research in Brazil (this information was also contained in the working documents for Plenary Session IV).

Research on biofuels in Brazil:

- Brazilian publications on biomass/bioenergy for 2001-2005 second place behind US (600 publications).
- Yield in litres/ha has increased at a rate of 4% per year over the last 25 years.
- Large increase in number of sugarcane varieties over this time. Six new varieties introduced per year, amounting to 500 varieties currently cultivated (based on standard breeding).
- Two spin-off companies recently bought for US\$300m.
- Research on genomics and functional genomics of sugarcane largely driven by biofuels.
- Development of flexi-fuel vehicles.
- State of Sao Paulo is investing heavily in biofuels: R\$48 million (2008), R\$300 million (next 10 years). Young investigator fund. FAPESP state of Sao Paulo research (1% of state GDP).
- Industry/university partnerships: Oxiteno, Braskem, Dedini

## **Plenary session IV: Biofuels and Innovation**

This session explored the role of innovation and technological development in the biofuels industry. The innovation that has occurred in the Brazilian sugarcane-base biofuels industry was a key theme. The highlights of this innovation are:

- Sugarcane productivity has doubled in the last 25 years.
- Litres of ethanol per hectare has tripled in the last 25 years from 2000 l/ha to 6000 l/ha (corresponds to an annual improvement of 4% per year).
- 1.9% annual reduction in productions costs (\$40/GJ to \$15/GJ over the last 25 years).
- Development of the flexi-fuel vehicle.

*Background reading for this session can be found at  
[http://www.biofuels2008.com/en/discursos\\_documentos.php](http://www.biofuels2008.com/en/discursos_documentos.php)*

### **Panel**

- Silvio Crestana (President of EMBRAPA, Brazil)
- Mohammed H. A. (President of African Academy of Science)
- Helena Chum (Researcher National Renewable Energies Laboratory, USA)
- John Melo (CEO of Amyns, USA)

- José Goldemberg (Professor at University of Sao Paulo and former Minister of Science and Technology, Brazil)
- Lúcia Melo (President of Strategic Studies and Management Center (CGEE), Brazil)
- Luís Fernando Laranja da Fonseca (Director of the Agriculture and Environment Programme of WWF Brazil, Brazil)
- Thérèse Martinet (Director of Public Affairs and Environment, Peugeot Citroën, France)

### Key points

- There has been continuous innovation in Brazilian biofuels over the last 30 years.
- Innovation is a complex process and its relationship with R&D is not simple.
- There is a need for tools to support transition from basic research to implementation.
- Regulatory frameworks, contacts and relationships, public/private partnerships and cooperation agreements are all important.
- In the last 8-10 years US research in bioenergy has been very successful due to the role of the Biomass R&D Board (a cross-sectorial board <http://www.brdisolutions.com/default.aspx>) which coordinates all R&D activities.
- Innovation can create the future.
- Product innovation (no compromise products: low cost, renewables, no need for infrastructure changes).
- Techno-economic assessments and comparable methodologies are important.
- Little correlation between investment and innovation.
- Brazilians starting to look at “closing the loop” (water, nutrients).

Detailed notes are given in Appendix.

### Plenary session V: Biofuels and the international market

This session explored the area of biofuel trade. The potential size of the future international biofuels market was emphasised. The focus was mainly on ethanol and the difficulties Brazil is facing selling ethanol to the US and Europe. Some of these barriers are due to the high sustainability standards that the fuels are required to meet and competition from subsidised domestic production. There was an attempt to broaden this debate to include developing African nations that might produce biofuels.

*Background reading for this session can be found at [http://www.biofuels2008.com/en/discursos\\_documentos.php](http://www.biofuels2008.com/en/discursos_documentos.php)*

#### Panel

- Roberto Rodrigues (President of the Agribusiness Superior Council of FIESP and former Minister of Agriculture, Brazil)
- Lakshmi Puri (Deputy Secretary-General of UNCTAD, India)
- Charlotte Opal (Roundtable on Sustainable Biofuels, Switzerland)
- Corrado Clini (Italy, IPCC, Italy)
- Manoel Jose dos Santos (President of the Agricultural Workers National Confederation, Brazil)
- Marcos Jank (President of the Sugarcane Industry Union, Brazil)
- Mauricio Tolmasquim (President of the Energy Planning Corporation, Brazil)
- Nick Goodall (CEO Renewable Fuels Agency, UK)

## **Key Points**

- International barriers exist for biofuels but not for petrochemicals.
- Political constraints to the realisation of the potential of biofuels are more relevant than physical constraints.
- Need to remove hidden agendas as part of the certification systems.
- The development of biofuels industries should make sure take a holistic approach that leads to a win for environment, trade and development.

Detailed notes are given in the Appendix.

## **Perspectives**

The discussion at the conference could be broadly broken into three camps: the Brazilian perspective, the African perspective and the USA/Europe perspective. I have tried to sum up these three perspectives below.

### **Brazilian perspective**

The Brazilian position seems to be targeted at the US and Europe to remove trade barriers to Brazilian ethanol, such as subsidies and certification requirements. There was emphasis on distinguishing Brazilian ethanol from biofuels from other sources such as corn or palm oil. There was also a lot of discussion about the sustainability aspects of Brazilian ethanol, e.g., not competing with food, impacting on Amazonian deforestation and quality of sugarcane workers conditions, etc. There was a strong opinion, particularly among the Brazilian sugarcane industry, that Brazilian ethanol has proved itself, that there was no need for more debate, and that some of the certification requirements are based on hidden agendas. There was not complete agreement in the Brazilian camp on the issues of exploitation of workers in the sugarcane industry and around the way in which the Government should be going about protecting the Amazon through the use of land use zoning, etc.

An interesting angle to the Brazilian argument was that biofuels are an opportunity for the economic development of other tropical areas, such as countries in sub-Saharan Africa. These countries could adopt the Brazilian sugarcane-to-ethanol model including the export of technology and skills. By including Africa in the debate Brazil has successfully broadened the debate. In fact, there was a strong argument from the Brazilian side about the need for other producers to be present in the market so that sugarcane-based ethanol could be a real international commodity. This would also address security-of-supply issues that importers may have if Brazil is the only producer.

### **African perspective**

The African nations present see biofuels (in particular the Brazilian sugarcane-based biofuels but also crops such as *Jatropha*) as a huge opportunity for economic development and for the provision of energy to remote areas. They see a lot of potential in biofuels but don't really see a pathway to realising this potential yet. They also see the need for outside investment (via, for example, the Clean Development Mechanism) and for technical assistance from Brazil. Certification is not a priority. African nations are responsible for only a small proportion of GHG emissions, but are likely to be significantly affected by climate change.

### **Europe/US perspective**

Certification is key to international biofuel markets. Certification and sustainability criteria must include indirect aspects such as land-use change. Subsidies may be necessary to get a country's production up and going, otherwise big producers (like Brazil) could force other players out. A question being debated in the US is "will there be a move away from subsidising corn-to-ethanol". Credit crisis is a big focus at present. There is a need to use the current crisis to redefine ourselves. Many see regional development as a key-positive component of

biofuels/bioenergy. New leadership in the US is likely to result in the US joining Kyoto and this will have an important impact on other countries participation. Many see that energy efficiency and demand side management should come first, renewables second. Fairest approach to climate change is agreements based on emissions per capita. In Kyoto there should be no distinction between developed countries and emerging economies, like Brazil and Korea for example. For their own biofuel development lignocellulosic biofuels are seen as the main area of focus.

## **Implications for New Zealand**

### **International context and implications for a future New Zealand biofuel industry**

If Brazil realises its aims of doubling production and exporting their model to sub-Saharan African countries, they claim they will be able to meet 10% of the world's petrol demand with ethanol. This is extremely significant and could have an impact on any ethanol imports to New Zealand and any domestic biofuels industry in New Zealand. The international context of biofuels, including not just developed countries but also developing countries, is likely to become increasingly important and is something that New Zealand needs to keep an eye on (if not actively participate in).

A clear message for the development of a domestic biofuels industry in New Zealand is the need for cross-sectorial engagement. In Brazil there is an inter-sectorial working group on biofuels made up of very high-level officials right across the relevant sectors. In the US a cross-sectorial biomass R&D board oversees all government-funded research in the bioenergy area and this is seen as quite successful. Another clear message is the need for a strong working partnership between government, industry and research. Technological innovation seems to be a key aspect to the Brazilian story and this requires not just basic R&D but pathways for uptake by industry and active facilitation by government. This point was also emphasised by the representative from NREL, who saw the reason for recent progress in the US as due to the biomass R&D board being able to bridge the innovation chain.

If New Zealand chooses to pursue the woody biomass to biofuels route (as outlined in the Bioenergy Options reports) this will have a number of advantages in the international market:

- sustainability certification for forests already exists, is well developed and could be extended to cover the production chain;
- indirect effects of biofuels such as deforestation become a non-issue as biofuels will be based on forestry;
- competition with food will also be a non-issue as long as arable land is not utilised;
- the biodiversity of plantation forests can be shown to be much higher than that of agricultural crops;
- fertiliser and irrigation are much reduced compared to agricultural crops; and
- based on an existing forestry industry (similar to the Brazilian case which was based on a sugar cane industry).

These aspects will be relevant even if New Zealand is not selling on the international market, as the certification of our biofuels would also impact on the footprint of other products that we export and the tourism industry. Ironically, as the focus is on the negative aspects of biofuels from agricultural crops, biofuels based on plantation forestry will be coming out of left-field (and may not even be on the agenda) and all the above positive aspects of plantation forestry will be hard for people to get their heads around.

## **New Zealand biofuel research and development**

Brazilian biofuel is a research and development success story. There is much New Zealand can learn from this. I see three broad avenues of research collaboration with Brazil that could be of benefit:

- lignocellulosic biofuels;
- sustainable land-based production systems; and
- strategic development of biofuels in New Zealand.

### **Lignocellulosic biofuels**

Lignocellulosic biofuels are being pursued by Brazilian research organisations, including EPRAPA (the Brazilian Agricultural Research Corporation) and a number of Sao Paulo Universities. Not all this research is concentrated on bagasse; in fact, Brazil has 3 million ha of planted forests. Two broad research themes in this area which are of interest are applications of biotechnology and energy forest development. As there are a number of other international organisations also investigating these areas, there would have to be a compelling reason why Brazilian organisations were favoured over any other for partnerships. Identification of research partnerships that offer synergies is best achieved by a detailed understanding of research at the scientist level.

At a more strategic level, partnership with Brazil seems to be an advantage. Brazil is the only country with a robust biofuels industry in place. This industry is facing clear drivers to reduce water use, increase nutrient recycling, increase energy efficiency and increase yields (which includes moving to lignocellulosic technologies). There also seem to be mechanisms in place for developments to be taken up by industry. For these reasons it would not be surprising if Brazil was the first country to implement lignocellulosic biofuel technologies on a commercial scale, integrated with their more traditional production systems. In light of this, the benefits of having research partnerships with Brazilian institutions should be investigated further.

### **Sustainable land-based production systems**

The sugarcane biofuels industry is facing clear drivers from international trading partners to increase the sustainability of their production systems. This has resulted in increased research into: reduced water use; increased nutrient recycling; and efforts to decrease fossil-fuel based fertilisers. This is an opportunity to leverage New Zealand's expertise in sustainable land-based management and production systems, waste water treatment and life cycle management. EMBRAPA is a key research organisation in this area. This was identified as an area of interest by John Gifford following his trip in June 2007.

### **Strategic development of biofuels**

Brazil has developed a successful biofuels industry. If New Zealand is interested in pursuing the same route (most likely based on another feedstock), there are definite learnings that can be taken on board. A key similarity in the case of forestry-based biofuels is that the Brazilian development was also based on an existing sugar industry. Understanding the pathway New Zealand could pursue including the role of government, industry and research could benefit from an analysis of the Brazilian model. One aspect of this is the inter-sectorial approach the Brazilians have taken to biofuel and the policies that have been put in place.

The innovation seen in the Brazilian biofuels industry seems to be a R&D success story. This innovation has occurred right along the production chain, from sugarcane breeding through to the development of flexi-fuel vehicles. A number of elements including government, industry and the research environment must have come together in Brazil for this innovation to occur. It is important for New Zealand to understand the mechanisms that enabled this to occur and see how it could be adopted here. The Centre for Strategic Studies and Management (CGEE) in Brazil could be useful partner in this area.

## References

Bioenergy in the state of Sao Paulo: Present Situation, Perspectives, barriers and Proposals, J. Goldemberg, F. E. B. Nigro and S. T. Coelho (2008)

Sugarcane-Based Bioethanol: Energy for Sustainable Development, coordinated by National Economic and Social Development Bank (BNDES) and Center for Strategic Studies and Management (CGEE) (Nov 2008)

Bioenergy & Biofuels in Brazil & Chile: Trip Report, John Gifford (2007).

Hall P and Gifford J, 2008; Bioenergy Options for New Zealand – Situation analysis (<http://www.scionresearch.com/bioenergy+report.aspx>)

Hall P and Jack M., 2008; Bioenergy Options For New Zealand: Pathways Analysis (<http://www.scionresearch.com/bioenergy+report.aspx>)

*Background reading for the plenary sessions can be found at [http://www.biofuels2008.com/en/discursos\\_documentos.php](http://www.biofuels2008.com/en/discursos_documentos.php)*

## Appendix: Conference Notes

### Opening Statements by Brazilian Officials

#### *Sao Paulo state representative*

- Most sugarcane grown in Sao Paulo district.
- 1% of Sao Paulo district GDP for research in biofuels.
- Planned R\$100 million for new bioenergy research centre for Sao Paulo.

#### *Chief of staff*

- Brazil is 47% renewable.
- Thirty years of bioethanol, five years of biodiesel.
- EMBRAPA key research provider (John Gifford in his report on his MFAT sponsored trip to Brazil in 18-25 June 2007 identified the usefulness of establishing a formal R&D relationship between NZ research organisations and EMBRAPA).
- Flexi-fuel vehicles allow a 0-100% ethanol/petrol mix.
- Since the beginning of the biofuels initiative in total 800 million tonnes of CO<sub>2</sub> has been avoided.
- Energy return on energy invested for Brazilian ethanol is 9.5:1.
- Water use has been decreasing from 10,000 to 1,000 litres per tonne of sugarcane.
- Sugarcane for biofuels makes up 0.5% of Brazil's agricultural land.
- The Brazilian government is planning to introduce a land-use/zoning policy to regulate land use (preserving regions such as the Amazon).
- Called for cooperative discussion on topic.

### Plenary session I: Biofuels and Energy Security

#### *Zimmermann*

- Energy security is equivalent to supply security. Supply security encompasses price and volume.
- In what way do biofuels contribute to energy security?
- Currently 20 countries produce oil for 200 countries, whereas 100 countries could potentially produce biofuels.

#### *Roberts*

- Price of oil real driver.

- Coal to liquids and tar sands real alternatives.

### ***Pinto***

- Developing countries can supply the world.

### ***Mayaki***

- In Africa less than 4% population have access to electricity.
- In Africa 88% of arable land not utilised.
- Biofuels could stop deforestation, use biofuels instead of wood.

### ***Johns***

- IEA report recently released.
- BAU Scenario: oil, gas and coal usage will rise, GHG will skyrocket, temperatures rise 6 deg and many people will have less access.
- Alternative scenario: lower prices, lower GHG emissions through increasing energy efficiency (50% contribution), increasing renewable energy (25%), carbon capture and storage (15%), increased nuclear
- Biofuels 1.5% share of energy mix (now), 8% by 2030; 26% by 2050

### ***Berg***

- Large uptake of ethanol in Americas.
- South America large ethanol usage because of existing infrastructure, high productivity land, North America due to aggressive policies.
- Infrastructure required in Asia and Africa.

### ***Question and answer session.***

- China from 1990 to 2006 became sixth largest market for vehicles.
- What is the potential contribution of biofuels? Political constraints more relevant than physical (Roberts).
- Efficiency must be a component of any energy system plan.
- Two-thirds oil left, but oil centred in very few countries. Investment in oil extraction not necessarily made (IEA report)
- By 2018/19, first-generation ethanol will not be enough; will require next generation technologies (Berg).
- International barriers exist for biofuels but not for petrochemicals.
- IEA publication: Deploying Renewables – best-practice policies
- African countries have large potential for the production of biofuels 200 million acres (Sudan). But no capital.
- Need long-term mandates (Berg).
- If factor in military expenditure protecting oil, fuel-cell vehicles with hydrogen competitive with oil.
- Don't forget other forms of bioenergy (Jones).

## **Plenary session II: Biofuels and Climate Change**

### ***Heller***

- Changes occurring in Kyoto Protocol. Price on carbon not working well.
- The simple, highly-general Kyoto Protocol likely to become a complex system of specific supporting policies.
- Movement away from cap-and-trade to policy measures.

### **King**

- Result of G8 meeting to reduce GHG by 50% by 2050. Currently 36 billion tonnes, BAU would have 68 billion tonnes by 2050. Aim to reduce to 18 billion tonnes. This is a huge ask!
- Approach:
  - ▶ Energy efficiency and demand side management;
  - ▶ Renewable energy;
  - ▶ Carbon capture and storage; and
  - ▶ Avoided deforestation.
- There is talk of using auction revenues to assist developing countries. (For example the ETS market in Europe is \$55 billion).
- Need to get to two tonne/person in every country.
- Strong policy measures required – New renewables energy policy (EU or UK, due next year). New standards in bioenergy.

### **Estrada-Oyuela**

- Science of climate change is different from the conventions that we have put in place (does not cover all aspects).
- Nature is not equal to government policy (for example nature does not distinguish developed versus developing countries).
- Fairest approach based on emissions per capita.

### **Feldmann**

- Use credit crisis to redefine our society/economy.
- Industry/government strategies should be about avoiding “stranded assets”:
  - ▶ urban design; and
  - ▶ integrated planning and design.

### **Tall**

- Africa responsible for only 4% of GHG but likely to suffer most from climate change.
- Use *Jatropha* to fight desertification and reconstitute soil.
- Sudan produces 0.1% of world GHG.

### **Flavin**

- World facing a credit crisis plus a ecological crisis.
- Need to reinvent ourselves.
- Crisis is an opportunity to consider new paradigms.
- Integrated production of food and energy.

### **General comments**

- Planted forests need to be included as part of the mix.
- Bioenergy important role in fighting poverty.
- Indirect land use change is important.
- 1% of 4-5 billion ha (land used for food) used to produce biofuels.
- Develop biofuels to develop agriculture and regional electricity (Africa).
- Pulp and Paper in Sweden is/will become an electricity and fuel exporter.
- Memorandum of understanding between Brazil and Sweden on biofuels.
- Need for a regional development plan for Africa.

## **Plenary Session IV: Biofuels and innovation**

### ***Martinet***

- Sustainable mobility has three factors:
  - ▶ energy supply/oil supply (energy efficiency);
  - ▶ emissions (low GHG); and
  - ▶ access to transport (cost).
- Car manufacturers consider a 20-year timeframe for cars.
- Flexi-fuel vehicles more expensive to produce.
- Need standards in order to produce better quality fuels.
- Citroën has a programme to decrease weight of cars and replace steel with plastic.

### ***Mohamed***

- Need research to improve efficiency of plants converting solar energy into liquid fuels (this includes the three aspects of plants, yield, engines).
- Need research into non-food crops.
- Need for an international centre of excellence in biofuels.
- Academies of science in various countries can provide evidence-based advice to governments.

### ***L. Melo***

- Innovation is a complex process not simply related to R&D:
  - ▶ interaction of science and society;
  - ▶ regulatory framework; and
  - ▶ requires contacts and relationships.
- New breakthroughs in fundamental science (such as biotech and nanotechnology) lead to new opportunities all along the production chain.
- Public/private partnerships important.
- Cooperation agreements.
- Need tools to support transition from basic research to implementation.
- There is a need at present for a joint effort to find bio-based fertilisers.

### ***Chum***

- Last 8-10 years US research in bioenergy very successful.
- Bioenergy R&D Board – sits across the whole innovation chain: research > development > commercialisation. Coordinates work across sectors.

### ***J. Melo***

- Innovation can create the future.
- Product innovation (no compromise products: low cost, renewables, no infrastructure changes).
- Feedstock innovation (sugarcane by far best feedstock).
- US has created a bankrupt industry.
- Need for a combination of public/private investment.
- Diesel fuels GDP growth as industrial transport is based on diesel vehicles.
- Bring together economic, energy and climate change policy (and sustainable land use).

### ***Goldemberg***

- There has been a continuous innovation in Brazilian biofuels over the last 30 years.
- 60% increase in employment compared to importing fossil fuels.
- Gasification should be considered.

### ***Fernando***

- Best energy is the energy you can save.
- Rethink the role of cars.
- In 1920 cars were made of 85% wood.
- Biofuels the cherry on the cake.

### ***General comments***

- EU aiming for a 30% reduction in GHG by 2030, 50% by 2050.
- EU joint agreement with Brazil in biofuels.
- For biofuels to become a traded commodity, need to expand production to other countries.
- Cooperation network.
- Important to disseminate research.
- Little correlation between investment and innovation.
- Goal setting important driver for innovation.
- There is no constant innovation cycle, can happen very fast: synthetic diesel molecule discovery > 2years to demonstration > 5 years to commercialisation.
- Techno-economic assessments important, comparable methodologies (rates). US model.
- Closing the loop (water, nutrients).

## **Plenary session V: Biofuels and the International Market**

### ***Jose dos Santos***

- Exploitation of workers in sugarcane industry.

### ***Goodall***

- Biofuels must meet high sustainability standards (include indirect land-use change).

### ***Opal***

- Standards facilitate market.

### ***Jank***

- Sugar cane second-best wage in labour.

### ***Puri***

- Biofuel development must result in:
  - ▶ win for environment;
  - ▶ win for trade; and
  - ▶ win for development.

### ***Clini***

- Tropical production 5x greater than elsewhere.